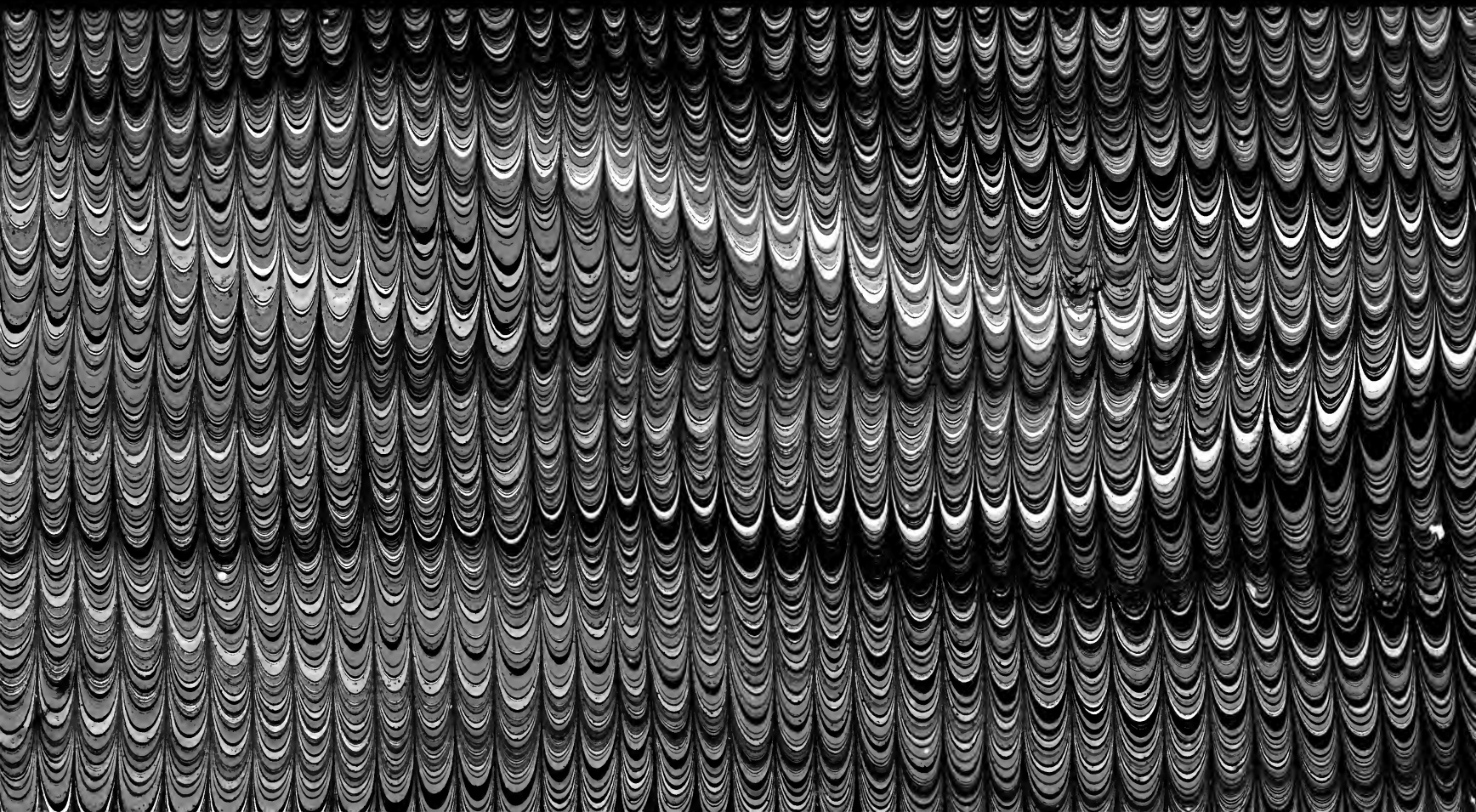

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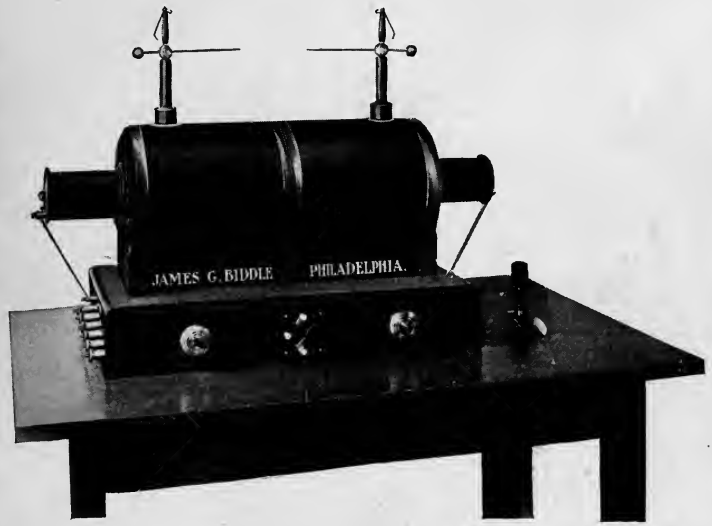
VERITATEM PER MEDICINAM QUÆRAMUS

ROENTGEN INDUCTION COILS

FOR QUICK WORK.



JAMES G. BIDDLE,

General Selling Agent,

1114 CHESTNUT STREET,

PHILADELPHIA, U.S.A.

ANNOUNCEMENT.

The Roentgen Manufacturing Co. has developed a line of *quick working* X-Ray apparatus which, in the hands of an *expert*, is capable of exceptionally rapid, as well as satisfactory, radiographic results.

This pamphlet is confined strictly to the particular class of work in view, which will explain the absence of data about coils and accessory apparatus for what may be termed "ordinary" X-Ray and therapeutic use, and which the Roentgen Manufacturing Co. is also prepared to supply.

A special feature is made of *showing apparatus in operation.* We have an exhibition room with photographic dark room attached and cordially invite prospective purchasers critically to examine the outfits which are displayed for that purpose. *When possible it is desirable to make an appointment in advance.*

If so desired parties who buy X-Ray outfits from us will be given thorough instruction in the manipulation of the apparatus, the taking of radiographs and the subsequent developing of plates. This is made possible by our very complete demonstration equipment.

We carry a stock of best quality X-Ray tubes, including "R. F." and "Gundelach" makes, for both large and small induction coils and for static machines.

JAMES G. BIDDLE,
General Selling Agent.

PHILADELPHIA, July, 1903.

Short Exposures, and the need for them.

In up-to-date X-Ray work the making of the exposure is but half of the work in the production of the negative. To make an adequate exposure in the shortest possible time requires the possession of a Roentgen coil and skill in its operation. The other half of the work is in the development of the plate. The radiographer must of necessity be a good photographer. He must know how to develop plates and develop them well. Experience, training and attention to detail are essential for successful development of photographic plates. The radiographer who wishes to do the quick exposure work should develop his plates himself, though it is not at all impracticable to have them developed by a professional photographer. The reason why he should do it himself is that the person who makes the exposure can far better develop a plate than another of equal ability who does not know how the exposure was made.

So that for this work the operator, needing to be in as close touch as possible with his apparatus, can usually do far better in the development of his own plates than another person.

The radiographer who is equipped with the most powerful apparatus should not expect to do the extremely rapid work (actual snap shots of the chest and other parts of the body, with exposures of one second or less) until he has become expert not only in the manipulation of his apparatus but has mastered the problem of the proper development of under-exposed plates.

The short exposure has come about mainly because time is valuable, and because too much difficulty has been experienced in keeping the patient still during the ordinary exposure, which is long as compared with "kodak" practice. A nervous, fidgety person even when bandaged to the plate gives trouble during long exposure. Children fearful lest some fancied harm may come to them, by their struggling prevent sharp definition. Often a position difficult to maintain is assumed by the patient during the exposure, and fatigue prevents him from keeping the original posture.

Though sufficient ones, these are not the only reasons for making short exposures. Radiographs taken by means of the short exposures show better and clearer definition with more of detail and differentiation of tissue density.

Prof. Goodspeed, of the University of Pennsylvania, and other investigators have shown that the tissues of the human body when bathed by the radiations from an X-Ray tube, themselves emit a secon-

dary radiation capable of slowly affecting a photographic plate The nature of this secondary radiation is similar to that of the Roentgen radiation itself. Its properties of invisibility and penetration seem to be the same, so that it has not been distinguished from feeble X-Rays. This secondary radiation is emitted by every particle of the body which is in the path of the radiation coming from the tube, and if it be in the presence of a photographic plate long enough it will affect it.

It is thus apparent that when a radiograph is taken, at least two kinds of radiation tend to affect the photographic plate, one which is weak tending to fog the plate, and the other which is comparatively strong and which produces the desired image. Should the exposure be long there will be sufficient time to permit of an appreciable fog by the secondary radiation from the tissues. The experience of every radiographer furnishes data for a confirmation of this fact. For it is well known that if it requires two minutes to produce a good radiograph of a particular case the good radiograph taken in the two minutes is not twice as good as the radiograph of the same case taken in but one minute. In fact, the radiograph taken by means of the shorter exposure will often show detail which is entirely lacking in the one made with the long exposure. Then again, the differentiation between the tissues in a skiagraph of the pelvic region seems to be less than it should be even when allowance is made for the extreme density of all the parts.

If the exposure be short enough, however, to prevent this secondary radiation which emanates from the tissues themselves from fogging the plate, the action on the plate will be by the X-Ray shadows alone and the negative will be sharper than with the long exposure. It is readily seen that in an ordinary radiograph of the denser parts of the body the fogging action is at a maximum because of the long exposure necessary to secure penetration and because of the large number of the sources of secondary radiation.

This conclusion is borne out by practice, and the efforts of the best workers are now directed to the making of their negatives in the shortest time possible.

There is another reason for making the exposure short and that is the lessening of the danger from burns. Foil, cloth or protecting covering of any kind gives small immunity from burns when long exposures are made, while with short exposures there is no need of a

protecting screen. The exposure is too short to produce a burn, and the absence of any material, but that the image of which is wanted in the negative, gives clearer definition. The importance of this method of eliminating burns is not to be overestimated. It is true that in therapeutic work it is generally desired to effect the burn, at least its appearance is expected in some degree ; but the really serious burns produced by long exposure to a highly excited tube are no longer excusable.

Still again, there is reason for the short exposure. In taking radiographs of the chest, if a satisfactory negative can be secured in a half second or less time the involuntary movement of the heart, together with the movements of breathing will not blur the plate. Such radiographs are most valuable in the diagnosis of pulmonary difficulties, and though difficult to make, can be produced by the use of our apparatus. Some workers have made most excellent radiographs of the chest in from twenty to thirty seconds, while the patient held his breath ; but the snap shot exposures have the advantage of detail and differentiation of tissue.

To make radiographs requires energy. If the energy be supplied to the tube slowly, a small generator of current can be employed, but if the same energy be given to the tube quickly a machine with a larger output must be used.

We shall, therefore, describe only *large* coils adapted to deliver heavy discharges to the X-Ray tube, so that the radiographs can be taken in the shortest possible time.

Also, these coils are most suitable for the long and continuous running required in therapeutic work, and are thus admirably adapted for heavy radiographic as well as therapeutic work. We shall be pleased to correspond with physicians interested in the apparatus adapted to both uses, and will gladly assist them in the fulfilment of their own particular conditions.

We are prepared to give a course of instruction in its use at our laboratory, to those of our patrons who can come to see us. Those who are unable to come to Philadelphia we will assist in learning the use of the apparatus by the correspondence method.

If the reader is not interested in the more recent and difficult radiographic work but wishes a machine of moderate size we shall be glad to furnish him information bearing on the subject if he will make inquiry of us.

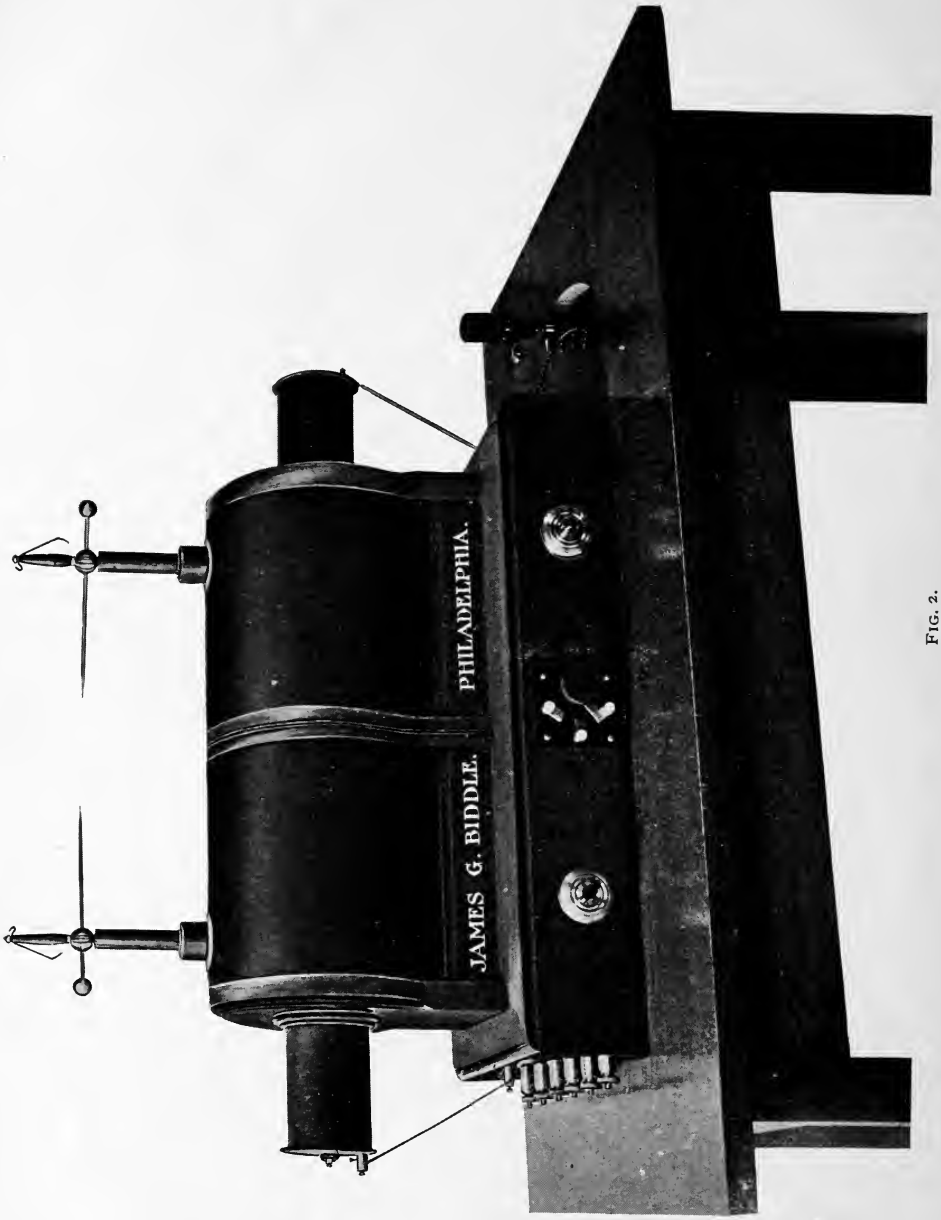


FIG. 2.

Roentgen Induction Coils of large capacity.

The induction coil shown on page 6 is adapted for use on either the direct or the alternating current with the Roentgen electrolytic interrupter. It is provided with series spark gaps, operating switch, reversing or pole-changing switch, rheostat for regulating the current and discharge rods for measuring the resistance of the X-Ray tube.

It will be noted that the rheostat is provided with a graduated scale for comparing the currents used at different times.

The wood-work of the coil is of the finest polished mahogany, that of the table is of cherry. Polished hard rubber insulation is used wherever high insulation is required, and the best of construction and finish is employed throughout.

This apparatus is capable of doing the heavier kinds of radiographic work required of an X-Ray expert, as well as the lighter therapeutic work, for which latter, however, it is not quite so satisfactory as the same coil equipped with mechanical interrupter.

This coil can be adapted to be operated by means of the mercury jet or the ordinary mechanical platinum interrupter, and will give the most satisfactory results obtainable with this kind of apparatus.

The construction of this induction coil has been made such that it will deliver VERY HEAVY DISCHARGES when operated for this purpose with the electrolytic interrupter or the mercury jet interrupter, while it will also give the lighter discharges as desired by simple adjustment of the interrupter. The flexibility of the apparatus is most desirable in covering the two fields of radiographic and therapeutic work as above noted.

All coils are guaranteed against breakdown with the exercise of ordinary care in use; and are generally made in one of two sizes—15″ or 18″ spark.

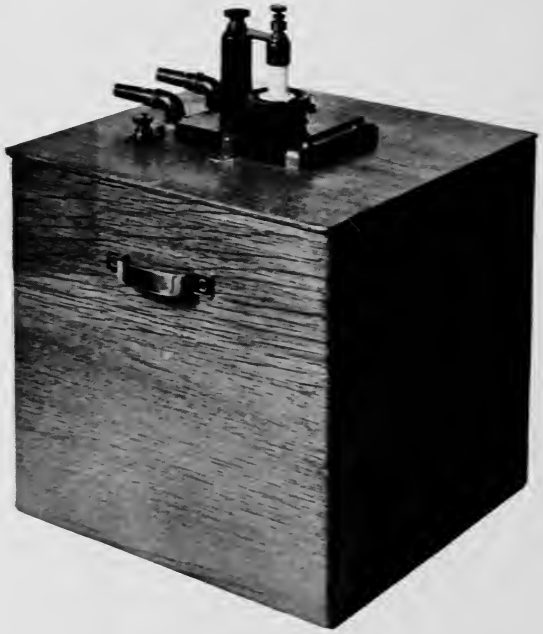


FIG. 3.

ROENTGEN ELECTROLYTIC INTERRUPTER.

Provided with water cooling attachment. It can be used with a Roentgen induction coil on direct or alternating current circuits of about 110 volts.

Roentgen Electrolytic Interrupter.

A large induction coil will not give a heavy secondary discharge unless it is supplied with a heavy primary current. The ordinary mechanical interrupter has not a sufficient current carrying capacity to permit of its use when the very heavy discharges are demanded of an induction coil for short exposures in radiographic work.

The electrolytic interrupter has, however, a large current carrying capacity, and is especially suitable for producing the heavy discharge.

It consists essentially of a small anode of platinum and a large cathode of lead immersed in a dilute solution of sulphuric acid. The interruption of the current occurs through the electrolysis of the water which liberates bubbles of gas at the anode, thus periodically insulating the anode from the solution and interrupting the current.

This rate of interruption is very high, being from 1,000 to 40,000 or more a minute.

In its operation the Roentgen electrolytic interrupter is almost without noise. It has no moving mechanical parts and is not subject to the limitations of apparatus which has them. It is simple in its construction and operation, with all parts accessible and adjustable.

The surface of platinum to be exposed to the electrolytic action is adjustable so that the coil can be made to deliver a thick, heavy discharge, or a light, thin one as desired. Fresh platinum surface can thus be exposed as it is worn away.

The interrupter can be conveniently placed to suit the requirements of the operator, as it is not necessary to mount it upon or with the coil.

Since the interruptions cease to be regular as the sulphuric acid solution warms up with use, the cathode is made of a lead tube through which water from a faucet should be passed when the interrupter is used for long and continuous running. Though the platinum is quite rapidly eaten away when the electrolytic interrupter is used on the alternating current, it is quite a satisfactory solution of the problem of the operation of an induction coil directly on the commercial alternating circuits without incurring the expense of a motor-generator.

The electrolytic interrupter does not require any condenser as must be used with the various forms of mechanical or mercury interrupters, and is thus very much less expensive than they are.

FIG 4

ROENTGEN THREE-ANODE ELECTROLYTIC INTERRUPTER.

A water cooling attachment is provided with this form, although not shown in the illustration.

The electrolytic interrupter can be made to deliver momentarily from ten to thirty amperes of current to a properly designed induction coil for the purpose of making a snap shot exposure, or it can be readily adjusted to furnish less current, as desired.

An experienced operator using the electrolytic interrupter with a Roentgen 15 inch coil can make a radiograph of the chest of an adult in from one to three seconds, while with an 18 inch coil he can make the exposure in but a fraction of a second, thus taking an actual snap shot of the beating heart.

The advantage of this very short exposure in diagnosis of the chest is appreciated without explanation.

Using the 15 inch coil with this interrupter the same operator will be able to make a radiograph of the pelvis of a male adult weighing about 175 pounds in from one minute and a quarter to two and a quarter minutes.

It is readily understood that the use of the electrolytic interrupter on large induction coils is the thing which has made possible the short exposure skiagraphic work.

We have spared no pains to make the most efficient and reliable electrolytic interrupter manufactured, and are confident that the excellence of its construction places it in the lead of its class.

Roentgen Three-Anode Electrolytic Interrupter.

This form of the electrolytic interrupter is designed to be placed some distance away from the coil itself. Each of the three anodes has its corresponding point on a three-point switch, mounted upon the coil so that the operator may use any one at his pleasure. When the anodes are adjusted to carry different amounts of current the character of the discharge from the coil can be changed readily from light to heavy and vice versa by simply changing the position of the switch. This modification is, in every other respect, like the usual form which is made with but one anode.

It is provided with handles mounted on its wood case, making it easily portable. The water cooling worm of lead tubing is just the same as in the other form.

The special hard porcelain construction of the anode is the same. The only difference in fact is the use of the three anodes, making it possible to set them for light, medium and heavy discharges of the coil respectively. After the anodes have once been adjusted, the different kinds of discharge can be obtained by the manipulation of the switches and the rheostat, the interrupter itself requiring no attention. It may be placed in another room if desired.

Roentgen Series Spark Gap.

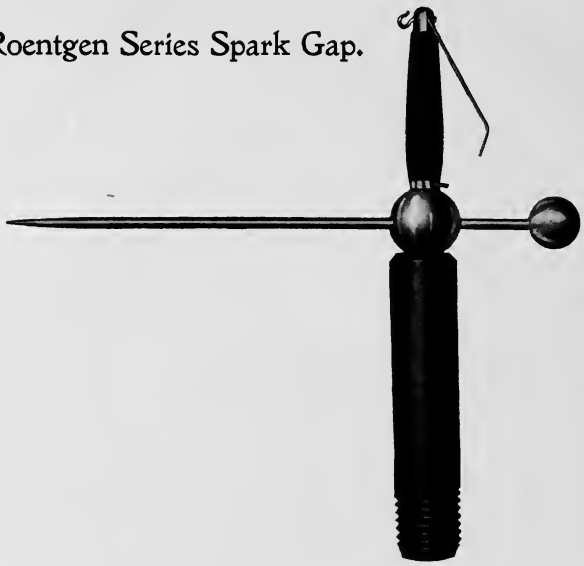


FIG. 5.

The well known phenomenon of the "inverse discharge" of the induction coil makes it advisable to use some form of resistance in series with the terminal of the induction coil and the X-Ray tube to prevent this inverse discharge from going through the tube. When this inverse discharge is permitted to pass through the tube a blackening of the inner walls of the tube occurs and is attributed to the deposition of the metal of the electrodes upon the glass. The most practical form of resistance has been found to be a spark gap placed in series with the terminal of the induction coil and the tube, as the inverse discharge often is of sufficient voltage to jump across the resistance of an inch of air or more. If the series spark gap is greater than the distance through which the inverse discharge will jump it cannot pass into the tube and blacken it.

The Roentgen series spark gap is readily adjusted to the top of the coil terminal by placing it in position, not requiring any binding posts for mounting it. For fastening the wires from the tube to it, there is provided a convenient brass hook which will be found a very simple attachment.

This form of series spark gap is the evolution of the work of several years in the attempt to obtain something "simple and efficient."

Comparative Exposures.

Since we are considering *short* exposures, to speak of the times of exposure necessary with our coils when equipped with *mechanical* interrupters may seem out of place, but we must do so to afford means of comparison between the mechanical and electrolytic interrupters.

Given a patient weighing not over 200 pounds and a heavy tube capable of withstanding the discharge from the coil the following is a list of comparative exposures which should be attained by the *experienced* worker:

Fifteen inch coil with Mechanical Interrupter.

Part	Distance from Plate	Exposure
Hand	12 inches	5 to 10 seconds
Foot	12 "	10 to 15 "
Shoulder	15 "	45 to 60 "
Hip-joint	20 "	4 to 7 minutes
Chest	18 "	40 to 50 seconds

Fifteen inch coil with Electrolytic Interrupter.

Part	Distance from Plate	Exposure
Hand	12 inches	1 to 2 seconds
Foot	12 "	1½ to 5 "
Shoulder	15 "	2 to 7 "
Hip-joint	20 "	1¼ to 2¼ min.
Chest	18 "	1 to 3 seconds

Eighteen inch coil with Mechanical Interrupter.

Part	Distance from Plate	Exposure
Hand	12 inches	3½ to 7 seconds
Foot	12 "	7 to 10 "
Shoulder	15 "	30 to 45 "
Hip-joint	20 "	3 to 5 minutes
Chest	18 "	35 to 45 seconds

Eighteen inch coil with Electrolytic Interrupter.

Part	Distance from Plate	Exposure
Hand	12 inches	½ to 1 second
Foot	12 "	1 to 3 "
Shoulder	15 "	1½ to 5 "
Hip-joint	20 "	¾ to 1½ min.
Chest	18 "	½ to 2 seconds

When equipped with both mechanical and electrolytic interrupters the Roentgen 15 inch coil is adapted to all kinds of work from the lightest therapeutic to the very difficult radiographic work.

Those desiring to do the ultra-rapid work (actual snapshots) will choose the Roentgen 18 inch coil used with the Roentgen electrolytic interrupter, for, on comparing the still shorter exposures possible with the 18 inch coil, with those obtainable with the 15 inch, it will be seen that the 18 inch coil is necessary to securing the best definition of the chest because of the involuntary motion of the heart, while there is a gain in the sharpness of definition due to the absence of the secondary radiation as heretofore noted.

The style of the 18 inch coil is the same as that of the 15 inch, and like it is furnished in polished mahogany finish unless otherwise desired.

We guarantee these coils to be of the best possible construction throughout. They will not break down with reasonable care in their use, and are made according to the principles of construction which have been found reliable by years of experience.

The Tube Question.

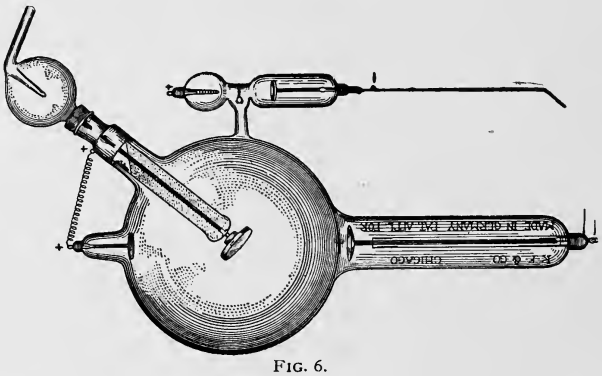


FIG. 6.

R. F. UNIVERSAL REGULATING TUBE.

With water cooling attachment.

There are no tubes made at the present time which can be expected to withstand the heaviest output of our large coils for any great length of time.

Should some one of the large tubes having a heavy anode of large thermal capacity be used the vacuum will not deteriorate if the heavy discharge be passed through it for but a short time. If on the con-

trary the current be continued long enough to heat the anode beyond a certain point, the vacuum will be lowered and the tube spoiled. This plan of operation requires much care and judgment in subjecting the tube to the terrific strain imposed upon it.

A different plan is that of using a tube with a water-cooled anode. This kind of a tube when well made can be used with less danger of having its vacuum lowered by hard running than any other form of tube obtainable, and though expensive, it is perhaps the most satisfactory tube that can be used for hard and frequent use in making quick radiographs.

We carry a comprehensive stock of X-Ray tubes and will furnish special price list upon request.

Upon inquiry we will recommend to the purchaser the tubes required to meet his particular needs.

Plates and Developer.

We are prepared to furnish plates especially made up for use in this quick work, and shall be pleased to make quotations for the same upon application.

These plates are coated with an especial emulsion which is made very sensitive to the Roentgen rays, and are the most satisfactory we have been able to secure for the difficult skiagraphic work.

The developer which we recommend for these special plates has been produced at the expense of long and careful investigation. Its formula we have found to be the one best adapted to these plates, though their development can be secured by means of any one of the well known developers.

We are prepared to demonstrate these extra sensitive plates to the purchaser at our laboratory at 1114 Chestnut St., Philadelphia, and will give to our customers, when it is desired, a course of instruction in the development of X-Ray plates, together with the general manipulation of our X-Ray apparatus.

PRICE LIST
OF
Roentgen Outfits for Quick Work.

While we prefer to negotiate specially with each customer so that his requirements may be met exactly, we mention here two typical X-Ray outfits, which are capable of the most *rapid* radiographic work. With such apparatus the results stated under "Comparative Exposures" can be obtained if the operator is properly expert. A novice cannot possibly hope to do it.

Roentgen 15-inch Outfit "A"..... Price $437.50

Comprising:

1 15-inch spark Roentgen Induction Coil.
1 Table for same, with 110-volt Rheostat.
1 Roentgen Electrolytic Interrupter, with water cooling attachment.
1 No. 7 R. F. Universal Regulating Tube.
1 No. 10 R. F. Universal Regulating Tube.
1 Large Floor Stand for Tubes.
1 Barium-platino-cyanide Fluoroscope, with 7x9 removable screen.
F. O. B. Philadelphia, boxing included.

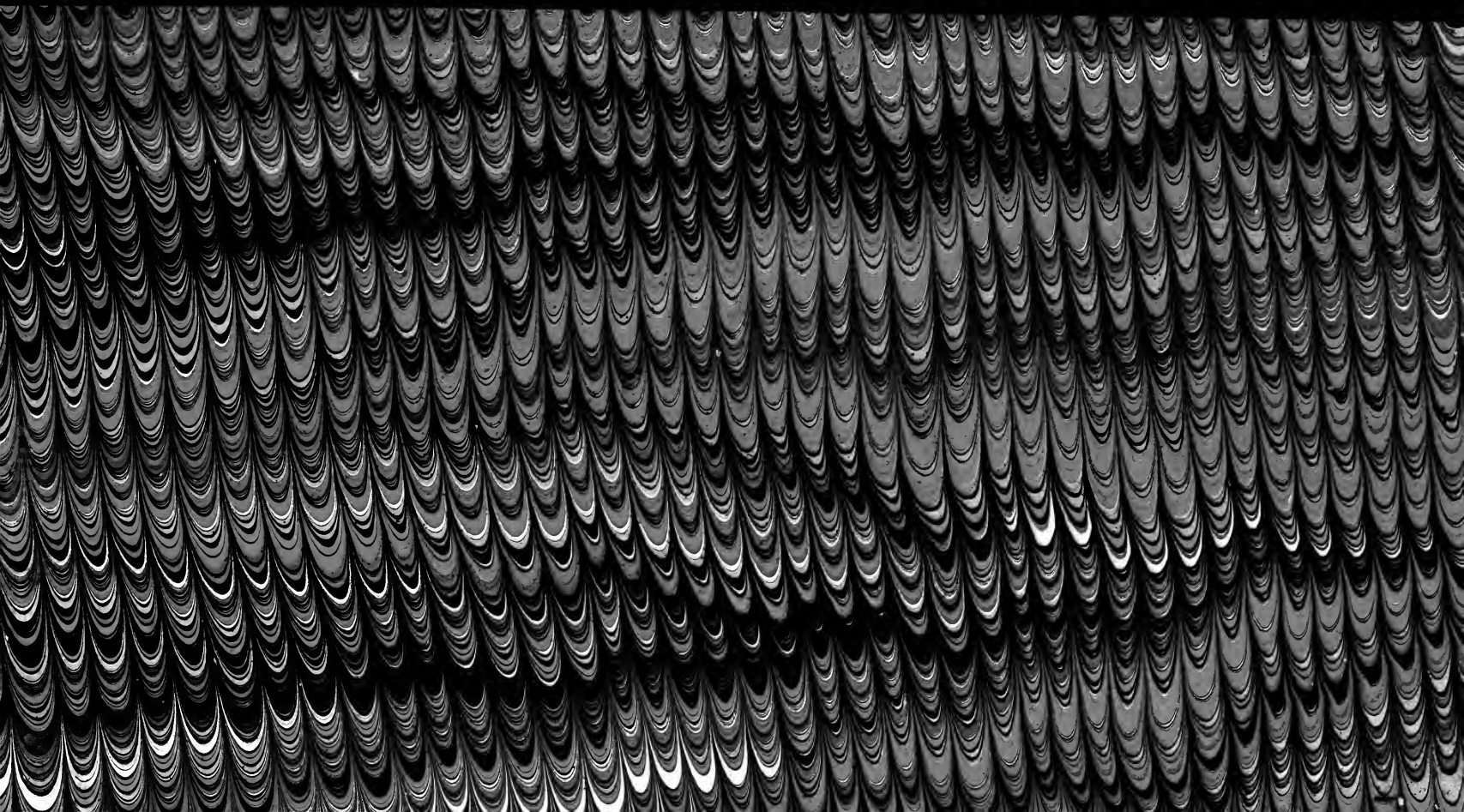
Roentgen 18-inch Outfit "B"..... Price $532.50

Comprising:

1 18-inch spark Roentgen Induction Coil.
1 Table for same, with 110-volt Rheostat.
1 Roentgen Electrolytic Interrupter, with water cooling attachment.
1 No. 10 R. F. Universal Regulating Tube.
1 No. 15 R. F. Universal Regulating Water Cooling Tube.
1 Large Floor Stand for Tubes.
1 Barium-platino-cyanide Fluoroscope, with 7x9 removable screen.
F. O. B. Philadelphia, boxing included.

Roentgen Outfits "A" and "B" can be operated from commercial electric light circuits of about 110 volts, either direct or alternating. The anode in an electrolytic interrupter is consumed much more rapidly by alternating current action, so that whenever possible we recommend that a direct current circuit shall be used.

Roentgen One-Anode Electrolytic Interrupter, (Fig. 4) **$40.00**

Roentgen Three-Anode Electrolytic Interrupter, (Fig. 5) .. **$90.00**

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